

5th World Conference on Educational Sciences - WCES 2013

Dual-coding versus context-availability: Quantitative and qualitative dimensions of concreteness effect

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Abstract

This paper examines the effects of dual coding theory through multimedia and context-availability method on vocabulary learning in English. The study was conducted with 61 university students at Nigde University by means of experimental method. The groups were determined depending on the students' final exam grades. Whilst vocabulary teaching via dual coding theory was applied to one of the groups, context-availability method was used in the other group. The results of the research showed that no significant difference was found between two groups with respect to vocabulary learning in English on post-test scores. At the end of the study, the students were interviewed in order to get their ideas about the methods applied to them.

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Selection and/or peer-review under responsibility of Academic World Education and Research Center.

Keywords: Dual-coding, Context-availability.

1. Introduction

Vocabulary learning which has a core effect on reading ability has been a problem for decades. Teachers of English try many different methods to overcome such kind of problems. In this study Paivio's dual coding theory and context-availability method were compared pertinent to their efficacy in vocabulary teaching in English.

1.1. Dual coding theory of paivio versus context-availability method

Dual coding theory explains human behavior and experience in terms of dynamic associative processes that operate on a rich network of modality-specific verbal and nonverbal representations (Clark & Paivio, 1991). Dual coding theory assumes that cognition occurs in two independent but connected codes: a verbal code for language and a nonverbal code for mental imagery (Sadoski, 2005). Information can be processed through both the verbal and nonverbal channels. This occurs, for example, when a person sees a picture of a dog and also processes the word "dog". Information processes through both channels has an additive effect on recall (Mayer & Anderson, 1991; Paivio & Csapo, 1973).

There are two important units in Paivio's dual coding theory. Logogens are language generators, imagens are image generators; both have useful in recognition. More specifically logogens are modality-specific (visual, auditory) units in the verbal systems that are activated by external stimuli or internally by other, previously activated

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mental representations. Imagens are modality-specific units in the nonverbal systems that are activated by external stimuli or internally by other, previously activated mental representations (Sadoski & Paivio, 2001).

In his study, Paivio successively presented concrete items that included repeated pictures, repeated words, and picture-word combinations. People recalled more items that were successively presented as picture-word combinations compared to repeated pictures or repeated words. Paivio believes that this effect resulted because people differentially encoded the successive picture-word combinations (Najjar, 1995). In the present study, firstly pictures were presented by means of multimedia. Then verbal equivalents of the pictures were presented to students. Some repetition activities were conducted in order to enable students to recall the words easily.

Dual coding theory has some outstanding hypothesis on vocabulary learning. One hypothesis is that nonverbal and verbal codes, being functionally independent, can have additive effects on recall. For example, participants in free recall experiments are likely to name presented objects covertly and thus create a nonverbal (pictorial) and a verbal memory trace. They can also set up a dual verbal-nonverbal memory trace by imaging to concrete words, but this is somewhat less likely than naming pictures, hence the lower memory for concrete words than pictures. Abstract words are difficult to image and hence are least likely to be dually coded (Clark & Paivio, 1991).

A question sometimes raised of dual coding theory is how we comprehend and respond to highly abstract language. The answer is that the encoding abstract language is primarily a matter of verbal associations. Consider the abstract sentence the basic idea remained vague. As with a more concrete sentence, this sentence can be phonologically recoded, grammatically parsed, and associated with other language units (e.g., basic idea = main thought, remained vague = stayed unclear). But beyond such mental parsing and paraphrasing, there is little substance to the sentence. Without a concrete contextual referent to concretize the abstract, it remains a verbalism with unrealized potential. Such sentences may be integrated as verbal units and achieve a degree of meaning at the associative level, but their fuller meaning and response awaits a more concrete context (Sadoski & Paivio, 2004).

Accordingly, an important distinction in dual coding theory is the difference between abstract language and concrete language. Abstract language has less access to nonverbal imagery (e.g., true), whereas concrete language has direct sensory referents (e.g., tree). In this theory, abstract language depends primarily on a web of verbal associations for its meaning. The abstract word true is largely defined by other language units such as not false, factual, real, faithful, and exact. Concrete language also evokes a web of language, but it additionally evokes nonverbal images as a form of meaning. Verbal associates for the concrete word tree might include trunk, roots, branches, and leaves, but the word also evokes referent images of trees of various kinds from the experience of the reader. Hence, concrete language enjoys a natural advantage over abstract language because it can be more readily represented and processed in two codes (Sadoski, 2005).

Another important point about the Paivio's dual coding theory is that people transfer their prior knowledge to new knowledge experiences. People learn better when the learning material involve related verbal and pictorial information compared to verbal material or pictorial material alone. It also appears that information presented through the pictorial channel is more salient and better remembered than information presented through the verbal channel (Najjar, 1995).

In opposition to the dual coding theory, the context-availability method argues that the faster recognition of concrete vs. abstract nouns results from a larger contextual support of concrete words and not from a distinct nonverbal system (Schwanenflugel & Shoben, 1983). In the same way Schwanenflugel & Stowe (1989) has an explanation in line with this theory. Concrete nouns activate more associative information, resulting in faster recognition of these items. If however, abstract nouns are presented in a meaningful context with sufficient verbal information, the concreteness effect disappears and abstract nouns are recognized as rapidly as concrete nouns.

Although a number of studies have been carried out in order to prove the concreteness effect in favor of one theory or the other, their effects on vocabulary learning of adult learners have been still under debate. The present study was carried out with 61 university students to identify the efficiency of dual coding theory, which proposes a verbal system located in the left hemisphere and a nonverbal system located in the right hemisphere, and context-availability method which has no specific emphasis on the hemispheres of the brain, but put the emphasis on a well-organized context.

2. Methods

2.1. Process

In the present study the subjects were university students attending preparatory school of engineering and science faculty. The groups were determined depending on their final exam scores. Two groups were formed by means of random sampling method. The words that would be taught were chosen from adjectives. Presentation material and assessment test were prepared by the researcher. Then, they were examined by eight instructors of English working at the same department with the researcher. As a consequence of their ideas and the feedback the assessment test was formed and applied. As a result of the reliability analysis of the test, the reliability coefficient (KR20) was found .76. The assessment test was applied to both groups and no significant difference was found between the scores of the groups in favor of any group. Before the methods were applied to the groups, pre-test was applied to both groups, and then the results were compared with independent-samples t-test analysis in order to demonstrate the similarity homogeneous of groups.

Table 1. Independent-samples t test results showing the difference between the pre-test scores of the groups

Groups	n	x	S	sd	t	p
Group 1	30	36.00	10.02			
Group 2	31	39.74	12.26	59	1.30	.189

p<0.05

No significant difference was identified between the pre-test scores of groups, which showed the similarity between the groups ($p < 0.05$). The result was convenient to prove the homogeneity of groups. The means of the pre-tests of the groups are respectively 36.00 and 39.74.

Next, one of the groups was applied dual coding theory while the other was applied context-availability method. The group applied dual coding theory was called as first group and the group applied context-availability method was identified as the second group. The presentation of the material lasted two weeks. After completing the presentation, post-test were applied to the groups. Finally the results were compared in order to identify which method was more effective in the way of vocabulary teaching in English.

2.1. Experiment

The students in the first group were applied the prepared presentation via overhead projector. They first saw the pictorial of the words. Next they were taught the definitions of those pictures and words. A set of vocabulary was taught in the same way. There was scope for students to exercise the words many times in the course of presentation.

The related words were presented in a reading and listening context to the students in the second group. They were not given the direct definition of the words. However they were supposed to deduce the meaning of the words from the context. They learned the vocabulary in a contextual way with the help of the words they knew in the context.

3. Results and findings

After finishing the presentation section of the study, assessment test were applied to participants in order to examine the efficiency of methods applied to groups. Then pre-test and post-test scores of each group were examined by means of paired samples t-test analysis. Paired samples t-test results showing the difference between the pre-test and post-test scores of the first group applied dual coding theory are given in Table 2.

Table 2. Paired samples t test results showing the difference between the pre-test and post-test scores of the first group

Group 1	n	x	S	sd	t	p
Pre-test	30	36.00	10.02			
Post-test	30	74.20	11.64	29	20.45	.000

p<0.05

In the analysis of related data, there found a significant difference between the pre-test and post-test scores of the first group ($p < 0.05$), which meant that dual coding theory is effective on vocabulary learning. For the first group, the mean of the pre-test is 36.00 and that of post-test is 74.20.

Another analysis was made in order to identify the difference between the pre-test and post-test scores of the second group applied context-availability method with paired samples t-test. The results are shown in Table 3.

Table 3. Paired Samples T Test Results Showing the Difference between the Pre-test and Post-test Scores of the Second Group

Group 1	n	x	S	sd	t	p
Pre-test	31	39.74	12.26			
Post-test	31	79.61	9.97	30	18.67	.000

$p < 0.05$

In the analysis of related data, there found a significant difference between the pre-test and post-test scores of the second group ($p < 0.05$), which means that context-availability method is effective on vocabulary learning. For the second group, the mean of the pre-test is 39.74 and that of post-test is 79.61.

Consequently, the scores of the assessment test applied to both groups were analyzed with independent-samples t-test. The related data can be seen in Table 4.

Table 4. Independent-samples t test results showing difference the post-test scores of the groups

Groups	n	x	S	sd	t	p
Group 1	30	74.20	11.64			
Group 2	31	79.61	9.97	59	1.95	.390

$p < 0.05$

No significant difference was found between the scores of the groups in favor of any group ($p < 0.05$), which meant that no method applied for efficient vocabulary teaching in the study were superior to another.

After the quantative part of the experimental process was completed, qualitative part was conducted in order to learn the opinions of the students of both groups about the methods applied to them. The students of both groups were interviewed in the way of the methods they were applied. The questions were;

- What are the advantages of the method for vocabulary learning (dual-coding theory/context-availability method) you were applied?
- What are the disadvantages of the method for vocabulary learning (dual-coding theory/context-availability method) you were applied?
- Do you have any suggestions for the process of the application?

To start with the responses of the students of the first group to which dual-coding theory was applied, most of them emphasized that visual effect of the method was very useful for vocabulary learning recalling the words after internalizing them. Some of the students cited that the associations of pictorials enable students to remember the words easily and permanently without any doubt. Three of the students claimed that dual-coding theory is more effective for learning adjectives rather than verbs or adverbs. Therefore, the method can be supported with other techniques. Four of the students suggested that while preparing the presentation, one should be very careful in order to clarify the differences between the similar words. One of the students said:

As I saw the pictorial of the word firstly, I was motivated to learn and I wondered about the word. Before I heard and saw the written form of the word, I had thought the related words that I had known beforehand.

As it comes to second group to which context-availability method was applied, most of the students stated that sometimes it was very difficult for them to deduce the meaning of unknown vocabulary as they had not known the meanings of the words which would lead them to find the meaning of the key word. Eight of the students emphasized that context-availability method was really boring since they had to know many words to deduce the meaning of key vocabulary. One of the students cited as following:

I sometimes felt myself inefficient and I was nervous as I didn't know the words around the word that I was expected to know. This method is generally too challenging.

However, one of the students expressed some pros of the method.

I think the method has lots of advantages. Firstly, it enables us to remember the words without looking through the text. We gain some associations of the word thanks to the other words around the unknown vocabulary. Secondly, I feel myself more confident about the word after learning it.

4. Conclusion

It appears that it is not possible to say that students learn better when the information is presented via either dual coding theory through multimedia or context-availability method. Pictures have value in providing meaningful comprehension in vocabulary teaching whilst context-availability method enables students to comprehend the words in a meaningful context. The finding of the present study replicate those of Marschark (1985) who failed to find significant difference between subjects concreteness effect. He used a set of paragraphs that presented the new vocabulary. In the present study some listening and reading passages were used to present the new vocabulary.

To start with the analysis of related data, there found a significant difference between the pre-test and post-test scores of the first group ($p < 0.05$), which meant that dual coding theory is effective on vocabulary learning. Secondly, there found a significant difference between the pre-test and post-test scores of the second group ($p < 0.05$), which means that context-availability method is effective on vocabulary learning. More importantly, no significant difference was found between the scores of the groups in favor of any group ($p < 0.05$), which meant that no method applied for efficient vocabulary teaching in the study were superior to another.

As Sadoski (2005) stated, meaningful vocabulary has been traditionally acquired through contextual analysis or by direct instruction in definitions. Using verbal contextual analysis alone to learn new vocabulary is a common educational technique that may not be potent enough to produce an advanced vocabulary. As well as this method, direct presentation of new vocabulary has a significant effect on learners. It can be suggested that instead of using these methods in an isolated way, an effective combination of them can be applied in a suitable setting. The data rather support a combination of both models. This view was also in the same line with that of Jessen et.al (2000).

In the light of the findings of both experimental and qualitative research, following suggestions have been given for tackling the problem and further studies:

- Dual-coding theory and context-availability method can be combined or used separately depending on the subject-matter in teaching and learning process.
- For the application of dual-coding theory, the teachers should be very careful for the convenience between the words and the pictorial of them. Interesting pictures can be useful for recalling the learned words.
- For the application of context-availability method, teachers should make use of some other techniques in order to avoid of boredom.

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